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REVIEWS

Fertilizer Resources of the United States*

A volume issued a few months ago by the U. S. government as Senate Document No. 190, with the title "Fertilizer Resources of the United States," contains much that is of interest to botanists and more particularly to students of the plants that grow in the sea, although this fact might not be wholly obvious to one who should go no farther than its title-page. 162 of the 290 pages of text in this document, 11 of the 19 plates, and all of the 19 maps are devoted to the marine algae and more especially to the larger kelps of our Pacific Coast and to the possibilities of making a practical use of these kelps as a source of potash for the American farmer and gardener. Nearly all of the potash that goes into the commercial fertilizers used in the United States now comes from the Stassfurt region of Germany, a region that represents a former sea-bottom, where certain soluble potassium salts have accumulated in a solid form by the concentration and final drying out of the sea-water. The Stassfurt mines are at the present time the one important source of the potash supply of the world, and the United States now imports from Germany more than \$12,000,000 worth of potash annually. Partly as a result of certain recent controversies between the German "Kali Syndikat" and American importers, the U. S. Congress instructed the Bureau of Soils of the Department of Agriculture and the U. S. Geological Survey to investigate the possibilities of discovering or developing within the boundaries of the United States a supply of potash that should be sufficient for the domestic needs. The first and most natural steps in this search for an independent American source of potash led to the alkaline basins of the arid West, especially where potassium salts in the surface "alkali" suggested the possibility of finding deposits of soluble potassium compounds comparable to those of the Stassfurt

* Fertilizer resources of the United States. Message from the President of the United States transmitting a letter from the Secretary of Agriculture, together with a preliminary report by the Bureau of Soils, on the fertilizer resources of the United States. Senate Document No. 190, 62d Congress, 2d Session. Pp. 1-290. *pl. 1-19 + maps 0-18*. Washington, 1912.

region of Germany, but thus far this search has not resulted in the discovery of any deposits of commercial importance, though borings, in certain localities, are still being carried on by the Geological Survey. The attention of the investigators has been seriously directed also to alunite, the feldspars, and the granitic rocks, into the composition of which potassium enters, but thus far the cost of separating out the potassium and converting it into a soluble form puts these rocks outside the lists of immediate economic sources of potash for the American farmer and gardener; however, alunite is looked upon as a promising possibility. The Washington scientists in their search for a domestic supply of potash took into consideration also the long-established use of seaweeds as a fertilizer for the soil by farmers living in vicinity of the sea and the well-proven fact that the beneficial effects of seaweeds thus used are due chiefly to the potash that they contain. Under the direction of the Bureau of Soils, detailed surveys of the extensive kelp beds of our Pacific Coast, particularly of the Puget Sound region and the southern half of California, have been made, and the amount of kelp annually available as a source of potash has been computed. Analyses made by the chemists of the Department of Agriculture (J. W. Turrentine, Appendix P, The composition of kelps, pp. 217-221) show that the amount of potash contained by the marine algae varies greatly with the species, place of collection, age of the plant, the part analyzed, etc. The three Pacific kelps that occur in sufficient abundance to make them important as a possible source of potash are *Nereocystis*, *Macrocystis*, and *Pelagophycus*. Dr. Turrentine found that 48.85 per cent. of the dry weight of the bulb of a young *Pelagophycus* plant consisted of potassium chloride and that *Macrocystis*, *Nereocystis*, *Pelagophycus*, and *Postelsia* showed an average content of 23.4 per cent. potassium chloride. As a result of the analyses and the field surveys carried on under the direction of the Bureau of Soils, Hon. James Wilson, the recent secretary of agriculture, in his letter of transmittal of Senate Document 190 feels justified in remarking: "It is regarded as a very conservative estimate to put the annual yield of potassium chloride from the Pacific kelps at upward of 1,000,000 tons, worth

at present prices nearly \$40,000,000." It is to be noted that this is more than three times the amount of potash now used annually in the United States. Mr. Milton Whitney, the chief of the Bureau of Soils, adds: "Moreover, it should be perfectly feasible to cover most, if not the entire, cost of production of this vast 'crop' by the iodine and other by-products produced simultaneously." Dr. Frank K. Cameron, under whose special direction the work has been carried on, sums up the potash situation in the United States as follows:

"In so far as present information goes, the Pacific kelp groves are and probably will remain by far the most important American source of potash. In fact, if carefully and skillfully husbanded they promise to approximate and perhaps even surpass, in importance and value, the famous Stassfurt mines. Alunite, important as it is, falls far behind."

The great kelps of the three genera chiefly considered live attached to the bottom in water that is mostly from 10 to 100 feet in average depth, whence they grow to the surface, forming extensive beds or groves. Detailed methods of cutting or harvesting in a practical and economic way have not yet been fully worked out, but it is believed that the problem offers no insuperable difficulties. *Nereocystis* and *Pelagophycus*, though sometimes growing to a length of from 60 to 150 feet, are annuals, while *Macrocystis* is apparently a perennial plant, and these facts will have to be considered in devising practical methods of harvesting and conserving the kelp groves. Professor George B. Rigg (Appendix L, Ecological and economic notes on Puget Sound kelps, pp. 179-193) finds that in Puget Sound the spores of *Nereocystis* are for the most part ripened and set free by July 15 and that after that date it would be possible to harvest this kelp without interfering with the next season's crop.

Besides the special papers already mentioned, Senate Document No. 190 includes a botanically important and useful paper on "The kelps of the United States and Alaska" (Appendix K, pp. 130-178) by Professor William Albert Setchell, embracing a general morphological and ecological account of the Laminariaceae, keys to the genera and species of both the Atlantic and Pacific coasts, and an interesting résumé of the past and present

economic uses of the kelps. Other papers are "The kelps of the central Californian coast" (Appendix M, pp. 194-208) by Professor Frank M. McFarland; "The kelps of the southern Californian coast" (Appendix N, pp. 209-213) by Captain W. C. Crandall; "Brief notes on the kelps of Alaska" (Appendix O, pp. 214-216), by Edward C. Johnston; "The technology of the seaweed industry" (Appendix Q, pp. 232-262), by Dr. J. W. Turrentine; "A discussion of the probable food value of the marine algae" (Appendix R, pp. 263-270), by Dr. C. L. Alsberg; and two bibliographical lists of anonymous authorship. Eleven of the nineteen plates attached to this Senate Document show habit photographs of various Pacific coast kelps; two photographs of *Nereocystis*, *in situ*, are especially striking. The nineteen maps show the position and extent of the kelp beds of the Puget Sound region and of the southern half of the coast of California. Some of the kelp beds, especially those of the perennial *Macrocystis*, are so dense as to afford some protection for certain harbors, acting as natural breakwaters, and it has been objected that the cutting away of these masses of kelp might endanger the safety of such harbors. To this objection the reply is made that the harbor of Santa Barbara, California, is probably the only one that might suffer in this way, and that any such undesirable effects of harvesting the kelps for their potash could probably be obviated by attention to the time and manner of cutting. It is of interest to observe, as already announced in the news columns of *Science* and of *TORREYA*, that during the present summer the Bureau of Soils is extending its detailed surveys of the Pacific kelp groves to Alaska.

MARSHALL A. HOWE